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HEALTHCARE FIRE SAFETY IN FRANCE

Guy MARLAIR (*) & Sabine FERNANDEZ-GARCIN (**)

(*) INERIS, Parc technologique Alata, BP2 F 60550 Verneuil-en-Halatte, France

(**) Ligeron SA, Les Algorithmes, bâtiment Euclide - Saint-Aubin F 91194 Gif-sur-Yvette, France

Abstract

Fire prevention and protection regulations for Public Access Buildings (PAB) exist in France since 1906. Since that time they have been regularly updated or fully reviewed in order to improve fire safety. The specific measures applying today to healthcare facilities are derived from a set of general fire safety regulations that covers all Public Access Buildings (PAB) including high-rise buildings.

This article briefly reviews the current technical and organisational measures which are enforceable by law and are aimed at controlling and reducing fire risk in public and private French healthcare facilities.

Healthcare facilities located in France are classified as building occupancies for designated use and as such must comply with either one or both (if relevant) of the following sets of safety rules included in official acts under the titles :

'*Regulation against Fire and Panic in Public Access Buildings*', latest full text release dated October 1980

'*Regulation regarding safety in High Rise Buildings (HRB) and protection against fire and panic in such structures*', latest full text release dated October 1977

These official documents, in addition to more general prescriptive codes, such as the '*Building Construction and Dwelling Code*', describe the measures that must be satisfied while designing the building (e.g. selection of fire resistant walls...), during implementation of other technical measures (such as availability and distribution of fire fighting devices) or by operational procedures during the use of the building (implementation of a fire safety service, training of the staff, information for the patients, maintenance of safety devices...).

The paper also briefly describes the regulatory scene in France, providing practical examples of requirements and comments in the light of the expertise of the authors.

Introduction

In France, the first genuine prevention policy in Public Access Buildings (PAB) with limited application was enforced by legislation as early as 1906. PAB are designated in France by the Acronym *ERP* for *Etablissements Recevant du Public*. Indeed, a special attention is obviously needed to prevent fire disasters in PAB, where safety impeding circumstances may be systematically feared. In fact, the members of the Public are very often unfamiliar with the building structures and with the related possible escape routes that could be used in the event of a fire.

Healthcare facilities have to cope with a still more critical background for the management of fire safety than in other types of PAB, since the members of the Public involving patients or visitors are most of the time highly stressed or deeply affected by emotion according to the medical reasons of their stay. Moreover, they generally have a very poor knowledge of the inner configuration of the building housing the healthcare occupancy and naturally, many patients have limited mobility. They may thus be confronted to huge difficulties for escaping by their own in case of emergency. In addition some areas in hospitals present special fire hazards (storage of flammable drugs, laundries...) and patients under heavy treatment in intense therapy units are nearly impossible to evacuate [1]. Therefore, healthcare facilities in France have for long been considered as a designated occupancy in PAB from a regulatory point of view, which has lead to reinforcement of general fire safety measures applying to PAB, taking account of the particular scene of hospitals.

Turning towards facts and figures, let us quote some statistical figures regarding healthcare bedding capacity in France and related firedeaths statistics that also stress the requirement of a good fire safety policy in this kind of building occupancy.

There is about 3500 healthcare institutions in France (exclusive of ambulatory care units) some 30% of them being State institutions and the other 70% private establishments [2].

These healthcare facilities represent an overall hosting capacity of some 552,800 beds. This figure is to be compared to the overall capacity of some 2,500,000 beds in the EU, among which 265,000 beds in the UK, 660,700 beds in Germany or 412,100 beds in Italy (figures from 1994).

Even if the existing accidentology records in France seem to reveal limited single fire disasters in healthcare compared to some other Nations, table 1 shows if necessary that the fire hazard in French healthcare facilities is also a reality.

Year	Place of occurrence	# of firedeaths
1918	State hospital, Oklahoma (USA)	38
1929	Hospital, Cleveland (USA)	125
1931	Home, Pittsburgh, Pennsylvania, (USA)	48
1953	Convalescent home, Largo, Florida (USA)	35
1960	Psychiatric hospital (Guatemala)	225
1968	Hospital, Shrewsbury (UK)	22
1969	Convalescent home, Notre Dame, (Canada)	54
1971	Psychiatric clinic (Switzerland)	28
1972	Hospital, Sherbone (UK)	30
1980	Convalescent home (Jamaica)	157
1980	Saint-Jean de Losne, (France)	32
1981	Aire sur Adour, (France)	24
1985	Hospital, Buenos Aires (Argentina)	79
1987	Nogent sur Marne (France)	8
1991	Thermal baths, Barbotan (France)	21
1993	Psychiatric Clinic, Bruz (France)	20
1996	Home, Nice (France)	3

Table 1: A selection of firedeaths records in hospitals in various countries (from [3])

Regarding frequency of fire occurrences in the sector, annual statistics from the BSPP (Fire brigades operating in the Paris sector) present 54 records of fire-fighting operations in healthcare premises in the Paris region during year 1995 only [4].

General framework of the actual legislation pertaining to fire safety in french health care premises

A first observation must be stated that concerns the prescriptive approach of the official current text, even if the performance-based approach has never been totally erased by application of the special rule described in article GN4 of [6].

Despite of the existence of some other minor

official texts to be considered for a complete regulatory analysis of fire safety in French healthcare premises, detailed prescriptions in matter of fire safety in healthcare premises are issued from the French *Ministry of Interior* (equivalent to UK Home Office) in regulatory texts summarised with their references in table 2.

A schematic broader view of the scope of those texts with their legislative origin is given in figure 1.

The French readers who would like to learn more about what is the real regulatory status applying to French care units, are invited to refer to documents [3] to [8] which give full details including comprehensive official and private comments.

The following are some main features of the regulatory scene regarding all types of French healthcare premises.

Types and categories of Public Access buildings and High-Rise Buildings

A general classification of PAB, into size classes (categories) valid to healthcare institutions, according to the importance of potential public simultaneously present in the premises is a basic consideration of the legislation for selecting the appropriate measures in terms of general fire safety philosophy, kinds of measures and level of strength. Table 3 outlines the main facts regarding this classification.

Classification of a complex institution comprising several buildings open to the public is operated by totalling the number of people in the larger 'non isolated' structures : basically, two structures are considered isolated from one another when a safe distance of min 8 meters between them is provided by construction or by use of adequate fire resistant walls, floors or ceilings to separate relative occupancies in neighboured structures.

Besides, tables 4 and 5 present the administrative distribution of various PAB according to main possible occupancies involving Public.

As can be seen, healthcare facilities are identified as designated « type U » PAB in the general case and 'G.H.U.' establishments when the activity is housed in a high-rise structure. About 10 such 'G.H.U.' institutions are numbered in the sole Ile-de-France administrative region [2]. Several others are existing in other regions.

Of course, measures regarding fire safety in healthcare premises are taking account of the size (i.e. category) of the facility and are basically more stringent, for equal category in a high-rise building than in a standard one. Moreover, some important measures of the current regulation (1977) in high-rise healthcare institutions have been given retrospective effects in 1982 for application in previously erected constructions.

Large healthcare institutions like *Centres*

<i>Regulatory code against fire and panic in PAB (so-called in French ERP)</i>	<i>Official law enforcement references</i>
General safety rules against fire and panic hazards in PAB (so-called ERP) included in the Building Construction and Dwelling Code (CCH)	Art. R123-1 to R123-55 of Decree #73-1007 of 31 October 1973 (several times modified)
Fire Regulation for PAB of 1941 (partly valid as soon as 1906 in the Seine administrative department)	Decree of 7 February 1941
Fire Regulation for PAB of 1954	Decree of 13 August 1954 (modified 1955, 1959))
Fire Regulation for PAB of 1965 (still partly valid for old healthcare facilities)	Decree of 23 March 1965 (modified 9 times)
Regulation of 25 June 1980 : Specific measures for health care premises May 1989 Complementary text for 5th category buildings issued in June 1990	Decree of 25 June 1980 (modified more than 20 times !)
Safety Regulation for High-Rise Buildings (so-called in French IGH) first release 1967	Decree of 15 November 1967
Safety Regulation for High-Rise Buildings (current full text)	Decree of 18 October 1977

Table 2 : Main regulation texts (successive releases, actual in bold) elaborated by the French Ministry of the Interior in application to the Building Construction and Dwelling Code ('CCH 'Art. 122/123)

<i>Group classes</i>	<i>category classes</i>	<i>size limits (# persons accounted for the public)</i>
	1st	> 1500
	2nd	from 701 up to 1500
<i>First Group of PABs</i>	3rd	from 301 up to 700
	4th	up to 300 but larger than specific limit for classification into 5th category
<i>second Group of PABs</i>	5th	limit specific to each type of PAB

Table 3: Distribution of PABs into size classes according to the importance of the public.

<i>1st group of PABs</i>	<i>Nature of activity involving public in buildings (conventional PABs)</i>	<i>Codified class of PABs (French so-called 'type')</i>
<i>In buildings</i>	Auditoriums, lecture rooms, meeting rooms and show rooms	L
	Stores, supermarkets, shopping malls	M
	Restaurants, pubs	N
	Hotels, boarding houses	O
	Dance halls, gaming-rooms	P
	Education institutions, children's holiday camp	R
	Libraries, documentation centres	S
	Exhibition halls	T
	Healthcare facilities	U
	Places of worship	V
	Administrations, Banks, Offices	W
	Covered places of sport	X
	Museums	Y
<i>Special types</i>	Floatings structures, railway stations, mountain inns, open-air institutions, covered car parks, Inflated structures, big tops or tents, refuges	EF, GA, OA, PA, PS, SG, CTS, REF

Table 4 : Distribution of PAB according to the nature of building use

Occupancy nature of buildings	Type of HRB criteria for classification as HRB
Residential accommodation (flats) ¹	G.H.A. floor level of upper storey more than 50 m up the highest ground platform accessible to the fire brigades trucks
Hotels	G.H.O. floor level of upper storey more than 28 m up the highest ground platform accessible to the fire brigades trucks
Institutions for Education	G.H.R. floor level of upper storey more than 28 m up the highest ground platform accessible to the fire brigades trucks
Places for archive storage	G.H.S. floor level of upper storey more than 28 m up the highest ground platform accessible to the fire brigades trucks
Healthcare premises	G.H.U. floor level of upper storey more than 28 m up the highest ground platform accessible to the fire brigades trucks
Offices	G.H.W. 1 floor level of upper storey between 28 m and 50 m up the highest ground platform accessible to the fire brigades trucks
Offices	G.H.W. 2 floor level of upper storey more than 50 m up the highest ground platform accessible to the fire brigades trucks
Combined use of more than one aforementioned activity	G.H.Z. floor level of upper storey more than 28 m up the highest ground platform accessible to the fire brigades trucks

Table 5 : Definition criteria and classification of High-Rise Buildings (HRB) including healthcare premises

Hospitaliers Universitaires (C.H.U.) have to cope with prescriptions of type U (and possibly to type G.H.U. high-rise buildings) but may also be subject in related areas to requirements applying for institutions of types L (meeting and lecture rooms), N (restaurants), R (Education areas for undergraduate physicians), or V (areas of worship) [9]

General philosophy of fire safety policy in hospitals

Concepts derived from general fire safety concerns in PABs

As in all PAB, another basic consideration is that the fire safety policy of healthcare premises in France is directed uniquely to life safety. As a result, property loss prevention -unless specially demanded by the insurers- is not directly aimed at by the texts which explains the very limited implementation of automated fire extinguishing systems in such areas in France.

As outlined by Orr [10], safe evacuation of the patients, visitors, medical and administrative staff either from the building itself or for the damaged 'zone' in complex structures is considered as the unique fire safety challenge in French hospitals and other care units.

To achieve such an operational result in case of emergency, basic measures comprising construction measures, additional various technical safety devices and organisational measures, have to be foreseen at the very beginning of a new healthcare project and duly implemented and maintained during all life of the activity, according to very detailed requirements given by the texts.

These measures can be classified into the following classes²:

- general administration ('GN' and 'GE' articles);
- construction requirements - CO art. (in matter of structural fire resistance, isolation from other buildings, internal distribution of rooms (traditional wall partition, compartmentation or sectorisation according to accurate meanings and technical observance of outlet routes, temporary refuges areas and building accessibility), stairways protection, sizing of evacuation routes, limitation of fire spread along front walls ('C+D' technical rule) or by ducts and cable trays...);
- limitation of fire loads and flame and smoke spread by use of adequate floor coverings, ceiling and wall linings and furniture (AM),
- smoke venting measures (DF),
- design of HVAC systems (CH), steam and hot water production systems,
- requirement for gas network (GZ),
- specifications for electrical systems and lighting systems (EL & EC),
- design and operation of lifts and escalators (AS)
- safety requirements regarding cooking devices and main kitchens (GC)
- implementation of rescue means (Active fire protection systems, mobile fire extinguishers, other fire-fighting facilities like hose-reels, buckets, in-house fire safety service, fire simulation exercises...) (MS)

Figures 2 and 3 illustrate two basic technical principles applying for fire safety considerations in all PAB.

Maintenance and checking requirements are included in each of the aforementioned category of measures. Rules for external control and survey of the actual application of the legislation by the Authorities have also been implemented by law enforcement, as well as penalty set out in case of non observance of duties by general managers and chief executives.

Customised features to take account of special fire risk typology in healthcare units

In French healthcare premises, the classification into the relevant categories of PABs results from the following calculation procedure of the public capacity:

- 1 person per bed
- 1 other person for three beds accounting for medical staff
- 1 other person per bed accounting for the patient visitors (1 per two beds in small establishments)
- 8 persons per consulting units or internal exploratory unit
- other members of the public size in other rooms of the institution under declaration of the healthcare General Manager.

The customised fundamental fire safety philosophy in terms of evacuation procedure consists in horizontal transfer of invalid patients towards a nearby fire protected zone and thereafter vertical transfer strictly limited to extreme emergency cases. valid people are however planned to be vertically evacuated (if required) to get out of the building.

Examples of technical measures for compliance with the fire regulation in healthcare premises

To satisfy the general fire safety policy previously explained, a set of technical measures apply involving for instance :

- reinforced structural fire resistance of inner distribution of rooms and medical wards (Division of medical wards into 'zones' -2 at least by hospitalisation level- , restricted use of compartments in terms of configuration, size - see table 6),
- increased accessibility of the building facades to the fire brigades motor trucks,
- increased severity regarding reaction to fire performance of inner linings,
- increased number and oversized dimensions of escapes routes and issues (rooms door of min 1.10 m of width, horizontal pathways of min. 1.40 m of width).

- extensive use of automatic fire detection (all sleeping areas, escape routes and hazardous areas) for achieving in any case early fire alarm,
- smoke venting of the corridors and other specified areas,
- classification and special treatment of areas presenting special hazards,
- adequate local means for internal fire fighting for disposal to fire brigades and (possibly) to home fire service.

Type of PAB	FR compartment size requirements (max. m ²) ³
L (except for show rooms)	1,200
R	600
S	1,200
U (healthcare premises)	1000 m2 (and max. 30 beds), special services only
W	800
X	1,600
Y	1,200

Table 6 : size requirements for fire resistant compartments in hospitals compared to those applying for other PABs

Another basic technical measure that was enforced by law in 1993 consists in the implementation of a fire safety system (*Système de Sécurité Incendie* or 'SSI') of category A (an 'A' type system is the most powerful existing one).

A fire safety system according to set of French standards NF S 61-931 to NF S 61-940 [11] is a fully integrated fire protection system of decreasing complexity according to categories A to E. Category A type comprises two main sub-systems called : 'SDI' (Category A only) automated Fire detection system, 'SMSI' automated safety procedures activation system. The equipment basically collects all useful information or orders regarding fire safety only (e.g. the gestion of other technical information useful for healthcare units monitoring are not allowed here), treats them and consequently operates and monitors all elemental safety functions like closing fire doors or shutters, management of evacuation procedures (alarm message diffusion, technical gestion of emergency exits...), activation of smoke venting, automatic fire fighting system - if any, and so on...

Administrative and organisational measures applying for healthcare units in France

A good human organisation in hospitals and other care units is a key factor to get sure that the fire safety goals will be preserved in any fire occurrence. The regulatory status in the field is thus very important

and stringent in terms of composition and qualification of the staff belonging to the fire safety service, in terms of information and simulation exercises of evacuation and fire fighting techniques and procedures. Provisions are also given to organise the external monitoring of the compliance of the regulatory texts by both external controls operated by agreed technical services and by inspections carried out by various safety commission on behalf of the authorities. At last but not least, the French regulatory scene also outlines the duty which is belonging primarily to the general manager of the healthcare unit who shall be aware of his obligation in terms of fire safety strategy as stressed recently by Charters talking about the related situation in the UK [12].

Organisation of the internal fire safety forces

New important features were brought into the field by official amendments in 1995. The scope of these amendments covers the organisation itself and qualifications required to become members of the fire safety service, in healthcare units as well as in other PAB.

For healthcare units, the regulation states that a fire safety service, independent to the external fire brigades forces, must be implemented according to specific rules in agreement with table 7.

As can be seen from table 7, particular attention has been brought on the allowed duties to fire safety service members in addition to normal fire safety concerns in order to prevent any deviation of the main duty of the fire safety forces that must obviously focus on fire safety purposes. The detailed duties in correspondence to the global fire safety mission assigned to fire safety services have also been given a regulatory framework.

More stringent rules are applying to G.H.U. types of healthcare units (which are generally consisting in big Public hospitals). There, all establishments (including old ones) must comply to demands requiring a permanent fire safety service comprising :

- one general safety officer for the high-rise building
- a central fire safety service department with 5 persons at minimum including a captain 24 hours a day
- one local fire safety section by compartment or medical ward (designated members are medical staff in charge of monitoring of the local activity, local captain designated by the management board)

The fire safety service must, among other mentioned duties, assure a permanent presence into the Central Safety Room located in the lower storeys where a permanent phone communication line is connected to the fire brigades. They must also go the watching rounds and organise fire fighting training for the staff and evacuation exercises.

Maintenance, repairs and checking operations

The pertaining regulation is very prescriptive in the field and states who (staff members of the healthcare institutions or external agreed services) may do what, and at what given frequency. These requirements covers for instance the SSI, the lifts, the fire doors, the fire or flame-proof shutters, the rescue means, the control of the allowed fire load...).

Survey of the safety records of the occupancy through the safety log-book

A 'log book' must be implemented and regularly updated which contains all records in relation of fire safety of the building. This document must even be initiated when the official application for a new healthcare occupancy is presented to the Authorities. It must contains the building construction licence, the nominative list of fire safety staff, all records regarding requested maintenance and checking operations, safety instructions prepared for emergency planning purposes, accident records and so on.

Type of healthcare establishment	Minimum requirements
Classified in first category	Specialised team in charge of fire safety service, min. of 3 persons simultaneously present, including one captain and one fire safety officer, captain and fire safety officer are not allowed to perform technical tasks without relationship with fire safety targets
Classified in other categories, but less than 1500 persons in total (by addition of all members of the Public in all buildings)	Designated staff members in charge of fire safety service in addition to normal medical duty, trained to use of rescue and escape means, head of task force may also be a designated staff member
Same classification as above, but more than 1500 people in several PABs of the establishment	Designated staff members or specialised staff, in any case under the management of a fire safety officer (whose duty is fire safety only)

Table 7 : basic rules for the implementation of the inner fire safety service according to the relevant category class of the healthcare occupancy

Category of PAB of type U	Time intervals between successive inspections of the Safety Commissions
1 st & 2nd categories	2 years
3rd & 4th categories	3 years
5th category	no scheduled visits at current state

Table 8 : Periodicity of Safety Commission Visits as requested since 1997

There is an evidence that this regulatory requirement is primarily lived as a constraint (among others) which may just help the Authorities to get a quick insight of the fire safety performance of the visited establishment. The authors' feeling is that this log-book, if correctly fed with the requested data should normally be at first a very useful tool for the proper validation of the fire safety policy by the management staff itself, since it is intended to contain the essential part of the information needed by them for provision of in-house monitoring of the operations.

Periodical visits of Safety Commissions

Safety Commissions is the external official body which has to report on the actual compliance of regulations that pertain to healthcare premises. A revision of their competence and their duties has been issued in 1996 which aims at increasing their efficiency. As a result, surprisingly, the planned periodicity of inspection visits of PABs and High-rise buildings that are part of their missions were slightly reduced in 1997, even in large hospitals of first category. The actual situation of periodical visits as requested by the new amendment follow rules expressed in table 8.

Formerly, 1st category hospitals were stated to be visited every year, which in practice was nearly never the real scenario, due to technical and organisational constraints. The new periodicity remains however at the highest level compared to other types of PABs [13]. In addition, unexpected visits may also be decided and operated by safety commissions.

Discussions on fire safety level in French healthcare premises

Lessons from some recent accidents (after [3])

Fire scenario at the Barbotan baths.

21 persons died from inhalation of fire gases inside the cure unit. The enquiry revealed that poorly controlled repairs on the roof using hot bituminous sheets were at the origin of fire. Fire propagation to ceiling of the swimming pool over the patients under treatment. Human error as well as major non compliance of the regulation (no escape route, no

fire detector, no extinguisher...!) associated with the absence of regulatory visits of the concerned Safety Commission were found to be the main reasons of the sinister. A sinister still discussed for penalty setting at the concerned French Court.

Fire in the Bruz psychiatric unit

This took place in 1993. As a result of voluntary intended fire by a young patient in an isolation room, 20 people were killed, 32 injured, the building nearly fully destroyed. Once again, major non compliance with the fire regulation was quickly outlined by the enquiry such as non encased stairways, no smoke venting, last visit of the Safety Commission dating from 9 years, no fire training offered to the medical staff of the establishment...

The Amarylis fire

This accident took place in a home for aged people with care facilities, end of 1996. Place of origin is a room at the floor level. Heavy smoke quickly filled in the nearby rooms still occupied. 18 persons were rescued by the fire brigades but three finally died a little later. Investigations revealed that doors remained opened, evacuation procedure operated with the Public was not appropriate, staff members were very limited in numbers.

For sure, it would be abusive to conclude that full compliance of the concerned fire regulation would have prevented from any occurrence of those fire disasters in healthcare units. But observed non conformities are so fundamental that they have obviously emphasised dramatically the role played by the human factor in the management of the evacuation.

Fire safety in hospitals housed in high rise buildings

M.M. Jeanroy claimed in [4] that no firedeath with the exception of one fire-fighter has ever been deplored in any of those constructions since the beginning of high-rise building French history. Available statistics tend to show that a very small proportion of fires occurrences are taking place in HRB compared to total figures related to all PABs including those housed in conventional buildings. The expertise of the authors leads to a less enthusiastic conclusion regarding the fire safety performance in healthcare occupancies in such type of buildings. We have been told by other experts of the medical scene

that this type of building make the overall safety issues required for this type of occupancy quite difficult and expensive to manage : as a consequence, new healthcare units in project in France are likely to reject this kind of architectural design.

Concluding comments

All information provided in the paper regarding the regulatory status of fire safety requirements shall be considered as non exhaustive : to achieve exhaustiveness, hundred of official text pages should be compiled and fully analysed and interpreted, not forgetting to seek for regular (sometimes monthly) updates ! In particular few consideration has been given here to special requirements in healthcare housed in high-rise buildings. However, degree of complexity as regards fire safety in healthcare in France seems to be less difficult to cope with than the general fire regulatory scene in the UK, as described by Andrew [14]

Moreover, the authors would like to express the feeling, in confirmation to other views expressed elsewhere [4] that the French regulatory framework - though sometimes boring to analyse and get use of - is one of the best and more efficient in the world, provided it is properly during all life of a given healthcare institution.

Some improvement is expected in the near future in terms of needed provisions together with simplification of the texts [15], and anyway, the interpretation of obscure prescriptions may always be requested by the Central safety Commission in charge of elaboration of the official documents. French priority users of the regulatory scene, that is to say architects, fire officers and chief executives of hospitals have the opportunity to organise themselves in a professional association [16/17] that may help in making fruitful discussions with the authorities.

The relative satisfaction that may be drawn out to some extent from the firedeath statistics in French healthcare shall be balanced by other technical considerations on the current background. For instance, we must also take account of the important ageing of many healthcare premises, including much Public establishments in Paris of very good medical reputation. There, technical constraints make it often nearly impossible to refurbish the building in order to bring it in line with the current structural fire protection quality level. In such old buildings, the professionalism of the fire safety teams and adequate measures of compensation (increased inspection procedures...) are of prime importance.

Indeed, the fire safety policy success relies in all cases on the efficiency of men and in the same time

the human factor is very often a cause of worry [18]. Above all, the fire safety policy must be directed and supported by the management board itself.

The duties are very broad and heavy in healthcare units. In particular, the fire safety concern must be properly integrated in a more global safety approach which comprises many other topics [19] (electrical safety, constant availability of medical gases, arson prevention, occupational safety...) : a very huge task indeed.

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